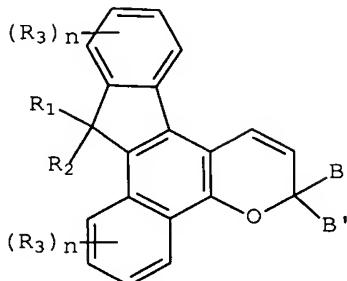


We claim:

1. A naphthopyran compound represented by the following graphic formula:

5

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15 wherein,

(a) R<sub>1</sub> and R<sub>2</sub> are each selected from the group consisting of:

(i) hydrogen, hydroxy, amino, mono- and di-substituted amino, C<sub>1</sub>-C<sub>6</sub> alkyl, C<sub>1</sub>-C<sub>6</sub> haloalkyl, C<sub>3</sub>-C<sub>7</sub>

20 cycloalkyl, allyl, benzyl, mono-substituted benzyl, halogen and the group, -C(O)W, wherein W is hydroxy, C<sub>1</sub>-C<sub>6</sub> alkyl, C<sub>1</sub>-C<sub>6</sub> alkoxy, phenyl, C<sub>3</sub>-C<sub>7</sub> cycloalkyloxy, mono-substituted phenyl, phenoxy, amino, mono(C<sub>3</sub>-C<sub>7</sub>)alkylamino, di(C<sub>1</sub>-C<sub>6</sub>)alkylamino, morpholino, piperidino or pyrrolidyl,

25 said amino substituents being selected from the group consisting of C<sub>1</sub>-C<sub>6</sub> alkyl, phenyl, benzyl and naphthyl, said benzyl and phenyl substituents being C<sub>1</sub>-C<sub>6</sub> alkyl, C<sub>1</sub>-C<sub>6</sub> alkoxy, piperidino, morpholino, di(C<sub>1</sub>-C<sub>6</sub>)alkylamino or fluoro;

(ii) unsubstituted, mono- di- and tri-

30 substituted members selected from the group consisting of phenyl, naphthyl, phenanthryl, pyrenyl, quinolyl, isoquinolyl, benzofuranyl, thienyl, benzothienyl, dibenzofuranyl, dibenzothienyl, carbazolyl, and indolyl, said group substituents in (a)(ii) being selected from the group

35 consisting of halogen, C<sub>1</sub>-C<sub>6</sub> alkyl, C<sub>1</sub>-C<sub>6</sub> alkoxy, morpholino, piperidino, pyrrolidino, amino, mono- and di-substituted

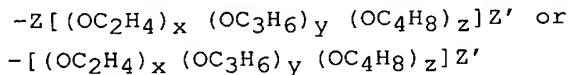
amino, said amino substituents being selected from the group consisting of C<sub>1</sub>-C<sub>6</sub> alkyl, phenyl, benzyl and naphthyl;

- (iii) monosubstituted phenyl, having a substituent at the para position that is a linking group,
- 5 - (CH<sub>2</sub>)<sub>t</sub> - or -O-(CH<sub>2</sub>)<sub>t</sub> -, wherein t is the integer 1, 2, 3, 4, 5 or 6, connected to an aryl group, which is a member of another photochromic naphthopyran;
- (iv) a group, -OR<sub>5</sub>, wherein R<sub>5</sub> is C<sub>1</sub>-C<sub>6</sub> alkyl, C<sub>1</sub>-C<sub>6</sub> acyl, phenyl(C<sub>1</sub>-C<sub>3</sub>)alkyl, mono(C<sub>1</sub>-C<sub>6</sub>)alkyl substituted phenyl(C<sub>1</sub>-C<sub>3</sub>)alkyl, mono(C<sub>1</sub>-C<sub>6</sub>)alkoxy substituted phenyl(C<sub>1</sub>-C<sub>3</sub>)alkyl, C<sub>1</sub>-C<sub>6</sub> alkoxy(C<sub>2</sub>-C<sub>4</sub>)alkyl, C<sub>3</sub>-C<sub>7</sub> cycloalkyl, mono(C<sub>1</sub>-C<sub>4</sub>)alkyl substituted C<sub>3</sub>-C<sub>7</sub> cycloalkyl, C<sub>1</sub>-C<sub>6</sub> haloalkyl, allyl, benzoyl, monosubstituted benzoyl, naphthoyl or monosubstituted naphthoyl, said benzoyl and
- 10 naphthoyl group substituents being C<sub>1</sub>-C<sub>6</sub> alkyl or C<sub>1</sub>-C<sub>6</sub> alkoxy; or R<sub>5</sub> is the group -CH(R<sub>6</sub>)Q, wherein R<sub>6</sub> is hydrogen or C<sub>1</sub>-C<sub>3</sub> alkyl and Q is -CN, -CF<sub>3</sub>, or -COOR<sub>7</sub>, and R<sub>7</sub> is hydrogen or C<sub>1</sub>-C<sub>3</sub> alkyl; or R<sub>5</sub> is the group, -C(O)V, wherein V is hydrogen, C<sub>1</sub>-C<sub>6</sub> alkoxy, phenoxy, mono- or di-(C<sub>1</sub>-C<sub>6</sub>)alkyl
- 15 substituted phenoxy, mono- or di-(C<sub>1</sub>-C<sub>6</sub>)alkoxy substituted phenoxy, an unsubstituted, mono- or di-substituted aryl group, amino, mono(C<sub>1</sub>-C<sub>6</sub>)alkylamino, di(C<sub>1</sub>-C<sub>6</sub>)alkylamino, phenylamino, mono- or di-(C<sub>1</sub>-C<sub>6</sub>)alkyl substituted phenylamino, or mono- or di-(C<sub>1</sub>-C<sub>6</sub>)alkoxy substituted phenylamino, said
- 20 25 aryl group substituents being C<sub>1</sub>-C<sub>6</sub> alkyl or C<sub>1</sub>-C<sub>6</sub> alkoxy;
- (v) a group, -CH(Q')<sub>2</sub>, wherein Q' is -CN or -COOR<sub>8</sub>, wherein R<sub>8</sub> is hydrogen, C<sub>1</sub>-C<sub>6</sub> alkyl, phenyl(C<sub>1</sub>-C<sub>3</sub>)alkyl, mono(C<sub>1</sub>-C<sub>6</sub>)alkyl substituted phenyl(C<sub>1</sub>-C<sub>3</sub>)alkyl, mono(C<sub>1</sub>-C<sub>6</sub>)alkoxy substituted phenyl(C<sub>1</sub>-C<sub>3</sub>)alkyl, or an
- 30 35 unsubstituted, mono- or di-substituted aryl group, each of said aryl group substituents being C<sub>1</sub>-C<sub>6</sub> alkyl or C<sub>1</sub>-C<sub>6</sub> alkoxy;
- (vi) a group, -CH(R<sub>9</sub>)G, wherein R<sub>9</sub> is hydrogen, C<sub>1</sub>-C<sub>6</sub> alkyl or an unsubstituted, mono- or di-substituted aryl group, and G is hydroxy, C<sub>1</sub>-C<sub>6</sub> alkoxy, aryloxy, amino, mono(C<sub>1</sub>-C<sub>6</sub>)alkylamino, di(C<sub>1</sub>-C<sub>6</sub>)alkylamino,

phenylamino, mono- or di-(C<sub>1</sub>-C<sub>6</sub>)alkyl substituted phenylamino, or mono- or di-(C<sub>1</sub>-C<sub>6</sub>)alkoxy substituted phenylamino, -COOR<sub>8</sub>, -COR<sub>10</sub> or -CH<sub>2</sub>OR<sub>11</sub>, wherein R<sub>10</sub> is hydrogen, C<sub>1</sub>-C<sub>6</sub> alkyl, an unsubstituted, mono- or di-substituted aryl group, amino,

- 5 mono(C<sub>1</sub>-C<sub>6</sub>)alkylamino, di(C<sub>1</sub>-C<sub>6</sub>)alkylamino, phenylamino, mono- or di-(C<sub>1</sub>-C<sub>6</sub>)alkyl substituted phenylamino, mono- or di-(C<sub>1</sub>-C<sub>6</sub>)alkoxy substituted phenylamino, diphenylamino, mono- or di(C<sub>1</sub>-C<sub>6</sub>)alkyl substituted diphenylamino, mono- or di(C<sub>1</sub>-C<sub>6</sub>)alkoxy substituted diphenylamino, morpholino, or  
10 piperidino, wherein R<sub>11</sub> is hydrogen, -C(O)R<sub>8</sub>, C<sub>1</sub>-C<sub>6</sub> alkyl, C<sub>1</sub>-C<sub>3</sub> alkoxy(C<sub>1</sub>-C<sub>6</sub>)alkyl, phenyl(C<sub>1</sub>-C<sub>3</sub>)alkyl, mono(C<sub>1</sub>-C<sub>6</sub>) alkoxy substituted phenyl(C<sub>1</sub>-C<sub>3</sub>)alkyl, or an unsubstituted, mono- or di-substituted aryl group, each of said aryl group substituents being C<sub>1</sub>-C<sub>6</sub> alkyl or C<sub>1</sub>-C<sub>6</sub> alkoxy; and

15 (vii) a group, T, represented by the formula:



wherein -Z is -C(O)- or -CH<sub>2</sub>-; Z' is C<sub>1</sub>-C<sub>3</sub> alkoxy or a polymerizable group, x, y and z are each a number between 0

20 and 50, and the sum of x, y and z is between 2 and 50; or

(viii) R<sub>1</sub> and R<sub>2</sub> together form an oxo group,

a substituted or unsubstituted spiro-carbocyclic ring containing 3 to 6 carbon atoms or a substituted or

unsubstituted spiro-heterocyclic group containing 1 or 2

25 oxygen atoms and 3 to 6 carbon atoms including the spirocarbon atom, said spiro-carbocyclic ring and spiro-heterocyclic group being annellated with 0, 1 or 2 benzene rings, said substituents being hydrogen or C<sub>1</sub>-C<sub>6</sub> alkyl;

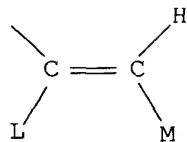
(b) each R<sub>3</sub> is independently selected from the

- 30 group consisting of hydrogen, C<sub>1</sub>-C<sub>6</sub> alkyl, C<sub>1</sub>-C<sub>6</sub> alkoxy, C<sub>3</sub>-C<sub>7</sub> cycloalkyl, phenyl, benzyl, di(C<sub>1</sub>-C<sub>6</sub>)alkylamino, dicyclohexylamino, diphenylamino, piperidyl, morpholinyl, pyridyl, halogen, a group, T, and the group -C(O)W and n is the integer 0, 1, or 2; or when n is 2, and the R<sub>3</sub>  
35 substituents are adjacent, each pair of substituents

independently forms a substituted or unsubstituted fused carbocyclic or heterocyclic ring selected from the group consisting of benzo, pyridino, pyrazino, pyrimidino, furano, dihydrofuran, 1,3-dioxolo, 1,4-dioxolo, 1,3-dioxino, 1,4-dioxino, thiopheno, benzofuro, benzothieno, indolo, and indeno, the substituents of said fused carbocyclic or heterocyclic ring being selected from the group consisting of halogen, C<sub>1</sub>-C<sub>6</sub> alkyl, C<sub>1</sub>-C<sub>6</sub> alkoxy, amino, mono- and di-substituted amino, said amino substituents being selected from the group consisting of C<sub>1</sub>-C<sub>6</sub> alkyl, phenyl, benzyl and naphthyl; said first R<sub>3</sub> ring being fused to the o, p or q side and said second R<sub>3</sub> ring being fused to the g, h, or i side of the naphthopyran;

- (c) B and B' are each selected from the group consisting of:
- (i) mono-T-substituted phenyl
  - (ii) an unsubstituted, mono-, di-, and tri-substituted aryl group;
  - (iii) 9-julolidinyl and an unsubstituted, mono- or di-substituted heteroaromatic group selected from the group consisting of pyridyl, furanyl, benzofuran-2-yl, benzofuran-3-yl, thienyl, benzothien-2-yl, benzothien-3-yl, dibenzofuranyl, dibenzothienyl, carbazoyl, benzopyridyl, indolinyl and fluorenlyl, each of said aryl and heteroaromatic substituents in (c) (ii) and (iii) being selected from the group consisting of hydroxy, aryl, mono(C<sub>1</sub>-C<sub>6</sub>)alkoxyaryl, di(C<sub>1</sub>-C<sub>6</sub>)alkoxyaryl, mono(C<sub>1</sub>-C<sub>6</sub>)alkylaryl, di(C<sub>1</sub>-C<sub>6</sub>)alkylaryl, haloaryl, C<sub>3</sub>-C<sub>7</sub> cycloalkylaryl, C<sub>3</sub>-C<sub>7</sub> cycloalkyl, C<sub>3</sub>-C<sub>7</sub> cycloalkyloxy, C<sub>3</sub>-C<sub>7</sub> cycloalkyloxy(C<sub>1</sub>-C<sub>6</sub>)alkyl, C<sub>3</sub>-C<sub>7</sub> cycloalkyloxy(C<sub>1</sub>-C<sub>6</sub>)alkoxy, aryl(C<sub>1</sub>-C<sub>6</sub>)alkyl, aryl(C<sub>1</sub>-C<sub>6</sub>)alkoxy, aryloxy, aryloxy(C<sub>1</sub>-C<sub>6</sub>)alkyl, aryloxy(C<sub>1</sub>-C<sub>6</sub>)alkoxy, mono- and di-(C<sub>1</sub>-C<sub>6</sub>)alkylaryl(C<sub>1</sub>-C<sub>6</sub>)alkyl, mono- and di-(C<sub>1</sub>-C<sub>6</sub>)alkylaryl(C<sub>1</sub>-C<sub>6</sub>)alkoxy, mono- and di-(C<sub>1</sub>-C<sub>6</sub>)alkoxyaryl(C<sub>1</sub>-C<sub>6</sub>)alkoxy, amino, mono(C<sub>1</sub>-C<sub>6</sub>)alkylamino, di(C<sub>1</sub>-C<sub>6</sub>)alkylamino, diarylamino, piperazino, N-(C<sub>1</sub>-C<sub>6</sub>)alkylpiperazino, N-arylpiperazino, aziridino,

- indolino, piperidino, morpholino, thiomorpholino,  
tetrahydroquinolino, tetrahydroisoquinolino, pyrryl,  
pyrrolidyl, C<sub>1</sub>-C<sub>6</sub> alkyl, C<sub>1</sub>-C<sub>6</sub> haloalkyl, C<sub>1</sub>-C<sub>6</sub> alkoxy,  
mono(C<sub>1</sub>-C<sub>6</sub>)alkoxy(C<sub>1</sub>-C<sub>4</sub>)alkyl, acryloxy, methacryloxy and  
5 halogen;
- (iv) an unsubstituted or mono-substituted  
member selected from the group consisting of pyrazolyl,  
imidazolyl, pyrazolinyl, imidazolinyl, pyrrolinyl,  
phenothiazinyl, phenoxazinyl, phenazinyl and acridinyl, each  
10 of said substituents being selected from the group consisting  
of C<sub>1</sub>-C<sub>6</sub> alkyl, C<sub>1</sub>-C<sub>6</sub> alkoxy, phenyl, and halogen;
- 15 (v) monosubstituted phenyl, having a  
substituent at the para position that is a linking group,  
-(CH<sub>2</sub>)<sub>t</sub>- or -O-(CH<sub>2</sub>)<sub>t</sub>-, wherein t is the integer 1, 2, 3, 4, 5  
or 6, connected to an aryl group, which is a member of another  
photochromic naphthopyran;
- (vi) a group represented by one of the  
following graphic formula:
- 20
- 
- wherein A is methylene or oxygen and D is oxygen or  
25 substituted nitrogen, provided that when D is substituted  
nitrogen, A is methylene, said nitrogen substituents being  
selected from the group consisting of hydrogen, C<sub>1</sub>-C<sub>6</sub> alkyl,  
and C<sub>2</sub>-C<sub>6</sub> acyl; each R<sub>12</sub> is C<sub>1</sub>-C<sub>6</sub> alkyl, C<sub>1</sub>-C<sub>6</sub> alkoxy,  
hydroxy, or halogen; R<sub>13</sub> and R<sub>14</sub> are each hydrogen or C<sub>1</sub>-C<sub>6</sub>  
30 alkyl; and q is the integer 0, 1, or 2;
- (vii) C<sub>1</sub>-C<sub>6</sub> alkyl, C<sub>1</sub>-C<sub>6</sub> haloalkyl, C<sub>1</sub>-C<sub>6</sub>  
alkoxy(C<sub>1</sub>-C<sub>4</sub>)alkyl, C<sub>3</sub>-C<sub>6</sub> cycloalkyl, mono(C<sub>1</sub>-C<sub>6</sub>)alkoxy(C<sub>3</sub>-  
C<sub>6</sub>)cycloalkyl, mono(C<sub>1</sub>-C<sub>6</sub>)alkyl(C<sub>3</sub>-C<sub>6</sub>)-cycloalkyl, halo(C<sub>3</sub>-  
C<sub>6</sub>)cycloalkyl, and C<sub>4</sub>-C<sub>12</sub> bicycloalkyl; and  
35 (viii) a group represented by the following  
graphic formula:



wherein L is hydrogen or C<sub>1</sub>-C<sub>4</sub> alkyl and M is selected from the unsubstituted, mono-, and di-substituted members of the group consisting of naphthyl, phenyl, furanyl, and thieryl,  
 5 each of said group substituents being C<sub>1</sub>-C<sub>4</sub> alkyl, C<sub>1</sub>-C<sub>4</sub> alkoxy, or halogen; or

- (d) B and B' taken together form fluoren-9-ylidene, mono-, or di-substituted fluoren-9-ylidene or a member selected from the group consisting of saturated C<sub>3</sub>-C<sub>12</sub>  
 10 spiro-monocyclic hydrocarbon rings, saturated C<sub>7</sub>-C<sub>12</sub> spiro-bicyclic hydrocarbon rings, and saturated C<sub>7</sub>-C<sub>12</sub> spiro-tricyclic hydrocarbon rings, each of said fluoren-9-ylidene substituents being selected from the group consisting of C<sub>1</sub>-C<sub>4</sub> alkyl, C<sub>1</sub>-C<sub>4</sub> alkoxy, and halogen; said halogen or halo group  
 15 herein being bromo, chloro, fluoro or iodo and said aryl groups herein being phenyl or naphthyl.

2. A naphthopyran compound of claim 1 wherein,  
 (a) R<sub>1</sub> and R<sub>2</sub> are each selected from the group  
 20 consisting of:

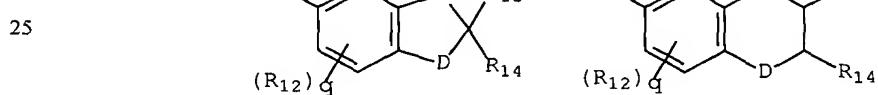
- (i) hydrogen, hydroxy, C<sub>1</sub>-C<sub>6</sub> alkyl, C<sub>1</sub>-C<sub>6</sub> haloalkyl, di-substituted amino, C<sub>3</sub>-C<sub>7</sub> cycloalkyl, benzyl, mono-substituted benzyl, and the group, -C(O)W, wherein W is C<sub>1</sub>-C<sub>6</sub> alkoxy, di(C<sub>1</sub>-C<sub>6</sub>)alkylamino, morpholino, or piperidino,  
 25 said amino substituents being C<sub>1</sub>-C<sub>6</sub> alkyl, said benzyl substituents being C<sub>1</sub>-C<sub>6</sub> alkyl or C<sub>1</sub>-C<sub>6</sub> alkoxy;  
 (ii) mono- di- and tri-substituted members selected from the group consisting of phenyl, naphthyl, and dibenzofuranyl, said group substituents in (a)(ii) being  
 30 selected from the group consisting of C<sub>1</sub>-C<sub>6</sub> alkyl, C<sub>1</sub>-C<sub>6</sub> alkoxy, di-substituted amino, said amino substituents being C<sub>1</sub>-C<sub>6</sub> alkyl;

- (iii) monosubstituted phenyl, having a substituent at the para position that is a linking group,  $-O-(CH_2)_t-$ , wherein t is the integer 3, 4, or 5, connected to an aryl group, which is a member of another photochromic 5 naphthopyran;
- (iv) a group,  $-OR_5$ , wherein  $R_5$  is  $C_1-C_6$  alkyl,  $C_1-C_6$  acyl,  $C_1-C_6$  alkoxy( $C_2-C_4$ )alkyl, benzoyl, or monosubstituted benzoyl, said benzoyl group substituents being  $C_1-C_6$  alkyl or  $C_1-C_6$  alkoxy; or  $R_5$  is the group  $-CH(R_6)Q$ , 10 wherein  $R_6$  is hydrogen and Q is  $-COOR_7$ , and  $R_7$  is  $C_1-C_3$  alkyl; or  $R_5$  is the group,  $-C(O)V$ , wherein V is  $C_1-C_6$  alkoxy, or di( $C_1-C_6$ )alkylamino;
- (v) a group,  $-CH(Q')_2$ , wherein  $Q'$  is  $-COOR_8$ , wherein  $R_8$  is  $C_1-C_6$  alkyl, or phenyl( $C_1-C_3$ )alkyl;
- 15 (vi) a group,  $-CH(R_9)G$ , wherein  $R_9$  is  $C_1-C_6$  alkyl, and G is  $C_1-C_6$  alkoxy,  $-COOR_8$ , or  $-CH_2OR_{11}$ , wherein  $R_{10}$  is  $C_1-C_6$  alkyl, di( $C_1-C_6$ )alkylamino, morpholino, or piperidino, wherein  $R_{11}$  is  $C_1-C_6$  alkyl, or  $C_1-C_3$  alkoxy( $C_1-C_6$ )alkyl; and
- 20 (vii) a group, T, represented by the formula:  
 $-[(OC_2H_4)_x(OC_3H_6)_y(OC_4H_8)_z]z'$
- wherein  $Z'$  is  $C_1-C_3$  alkoxy or a polymerizable group, x, y and z are each a number between 0 and 50, and the sum of x, y and z is between 2 and 50; or
- 25 (viii)  $R_1$  and  $R_2$  together form an oxo group, or a substituted or unsubstituted spiro-heterocyclic group containing 1 or 2 oxygen atoms and 3 to 6 carbon atoms including the spirocarbon atom, said spiro-heterocyclic group being annellated with 1 or 2 benzene rings, said substituents 30 being or  $C_1-C_6$  alkyl;
- (b) each  $R_3$  is independently selected from the group consisting of hydrogen,  $C_1-C_6$  alkyl,  $C_1-C_6$  alkoxy, di( $C_1-C_6$ )alkylamino, piperidyl, morpholinyl, pyrrolidyl, halogen, a group, T, and the group  $-C(O)W$  and n is the integer 35 0, 1, or 2, or when n is 2, and the  $R_3$  substituents are

adjacent, a pair of substituents independently forms a substituted or unsubstituted fused carbocyclic or heterocyclic ring selected from the group consisting of benzo, dihydrofuran and benzofuro, the substituents of said fused carbocyclic or heterocyclic ring being selected from the group consisting of C<sub>1</sub>-C<sub>6</sub> alkyl, C<sub>1</sub>-C<sub>6</sub> alkoxy, and di-substituted amino, said amino substituents being C<sub>1</sub>-C<sub>6</sub> alkyl; said R<sub>3</sub> ring being fused to the o, p or q side of the naphthopyran;

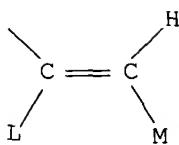
(c) B and B' are each selected from the group consisting of:

- (i) a mono-, or di-substituted phenyl group;  
(ii) an unsubstituted, mono- or di-substituted heteroaromatic group selected from the group consisting of furanyl, benzofuran-2-yl, thienyl, benzothien-2-yl, and dibenzofuranyl, each of said phenyl and heteroaromatic substituents in (c) (i) and (ii) being selected from the group consisting of hydroxy, amino, mono(C<sub>1</sub>-C<sub>6</sub>)alkylamino, di(C<sub>1</sub>-C<sub>6</sub>)alkylamino, piperidino, morpholino, pyrryl, C<sub>1</sub>-C<sub>3</sub> alkyl, C<sub>1</sub>-C<sub>3</sub> chloroalkyl, C<sub>1</sub>-C<sub>3</sub> fluoro-alkyl, C<sub>1</sub>-C<sub>3</sub> alkoxy, mono(C<sub>1</sub>-C<sub>3</sub>)alkoxy(C<sub>1</sub>-C<sub>3</sub>)alkyl, fluoro and chloro;  
(iii) a group represented by one of the following graphic formula:



wherein A is methylene and D is oxygen; each R<sub>12</sub> is C<sub>1</sub>-C<sub>3</sub> alkyl, or C<sub>1</sub>-C<sub>3</sub> alkoxy; R<sub>13</sub> and R<sub>14</sub> are each hydrogen or C<sub>1</sub>-C<sub>4</sub> alkyl; and q is the integer 0, or 1;

- (iv) C<sub>1</sub>-C<sub>4</sub> alkyl,  
(v) a group represented by the following graphic formula:



wherein L is hydrogen or methyl and M is phenyl or selected mono-, substituted phenyl, said phenyl substituent being C<sub>1</sub>-C<sub>3</sub> alkyl, C<sub>1</sub>-C<sub>3</sub> alkoxy, or fluoro; or

- 5       (d) B and B' taken together form fluoren-9-ylidene, mono-substituted fluoren-9-ylidene or a member selected from the group consisting of saturated C<sub>3</sub>-C<sub>8</sub> spiro-monocyclic hydrocarbon rings, saturated C<sub>7</sub>-C<sub>10</sub> spiro-bicyclic hydrocarbon rings, and saturated C<sub>7</sub>-C<sub>10</sub> spiro-tricyclic hydrocarbon rings, said fluoren-9-ylidene substituent being selected from the group consisting of C<sub>1</sub>-C<sub>3</sub> alkyl, C<sub>1</sub>-C<sub>3</sub> alkoxy, fluoro and chloro;
- 10

3. A naphthopyran compound of claim 2 wherein:

- 15       (a) R<sub>1</sub> and R<sub>2</sub> are each selected from the group consisting of:
- (i) hydrogen, hydroxy, C<sub>1</sub>-C<sub>3</sub> alkyl, and the group, -C(O)W, wherein W C<sub>1</sub>-C<sub>6</sub> alkoxy, or morpholino;
- (ii) unsubstituted, and mono-substituted phenyl, said phenyl substituents in (a)(ii) being selected from the group consisting of C<sub>1</sub>-C<sub>6</sub> alkoxy, and di-substituted amino, said amino substituents being of C<sub>1</sub>-C<sub>3</sub> alkyl,
- (iii) monosubstituted phenyl, having a substituent at the para position that is a linking group, -O-(CH<sub>2</sub>)<sub>t</sub>- wherein t is the integer 3, connected to an aryl group, which is a member of another photochromic naphthopyran;
- (iv) a group, -OR<sub>5</sub>, wherein R<sub>5</sub> is C<sub>1</sub>-C<sub>6</sub> alkyl, C<sub>1</sub>-C<sub>6</sub> alkoxy(C<sub>2</sub>-C<sub>4</sub>)alkyl, the group -CH(R<sub>6</sub>)Q, wherein R<sub>6</sub> is hydrogen or C<sub>1</sub>-C<sub>3</sub> alkyl and Q is -COOR<sub>7</sub>, and R<sub>7</sub> is C<sub>1</sub>-C<sub>3</sub> alkyl; or R<sub>5</sub> is the group, -C(O)V, wherein V is C<sub>1</sub>-C<sub>6</sub> alkoxy;
- (v) a group, -CH(Q')<sub>2</sub>, wherein Q' is -COOR<sub>8</sub>, wherein R<sub>8</sub> is C<sub>1</sub>-C<sub>6</sub> alkyl.

(vi) a group,  $-\text{CH}(\text{R}_9)\text{G}$ , wherein  $\text{R}_9$  is  $\text{C}_1\text{-}\text{C}_6$  alkyl and  $\text{G}$  is  $\text{C}_1\text{-}\text{C}_6$  alkoxy,  $-\text{COOR}_8$ ,  $-\text{COR}_{10}$  or  $-\text{CH}_2\text{OR}_{11}$ , wherein  $\text{R}_{10}$  and  $\text{R}_{11}$  are each  $\text{C}_1\text{-}\text{C}_6$  alkyl; and

(vii) a group,  $\text{T}$ , represented by the formula:

5  $-[(\text{OC}_2\text{H}_4)_x (\text{OC}_3\text{H}_6)_y (\text{OC}_4\text{H}_8)_z]Z'$

wherein  $Z'$  is  $\text{C}_1\text{-}\text{C}_3$  alkoxy or a polymerizable group,  $x$ ,  $y$  and  $z$  are each a number between 0 and 50, and the sum of  $x$ ,  $y$  and  $z$  is between 2 and 50; or

10 (viii)  $\text{R}_1$  and  $\text{R}_2$  together form an oxo group, a substituted or unsubstituted spiro-heterocyclic group containing 1 oxygen atom and 6 carbon atoms including the spirocarbon atom, said spiro-heterocyclic group being annellated with 2 benzene rings, said substituents being  $\text{C}_1\text{-}\text{C}_3$  alkyl;

15 (b) each  $\text{R}_3$  is independently selected from the group consisting of hydrogen,  $\text{C}_1\text{-}\text{C}_6$  alkyl,  $\text{C}_1\text{-}\text{C}_6$  alkoxy, morpholinyl, a group,  $\text{T}$ , and the group  $-\text{C}(\text{O})\text{W}$  and  $n$  is the integer 0, 1, or 2, or when  $n$  is 2, and the  $\text{R}_3$  substituents are adjacent, the pair of substituents independently forms a 20 substituted or unsubstituted fused carbocyclic or heterocyclic ring selected from the group consisting of benzo, and benzofuro, the substituents of said fused carbocyclic or heterocyclic ring being  $\text{C}_1\text{-}\text{C}_6$  alkoxy; said  $\text{R}_3$  ring being fused to the o, p or q side of the naphthopyran;

25 (c)  $\text{B}$  and  $\text{B}'$  are each selected from the group consisting of:

(i) an unsubstituted, mono-, or di-substituted phenyl group;

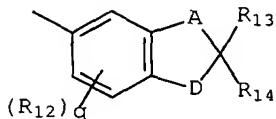
(ii) an unsubstituted, mono- or di-

30 substituted heteroaromatic group selected from the group consisting of furanyl, benzofuran-2-yl, thienyl, benzothien-2-yl, and dibenzofuranyl, each of said phenyl and heteroaromatic substituents in (c) (i) and (ii) being selected from the group consisting of hydroxy, piperidino, morpholino,  $\text{C}_1\text{-}\text{C}_3$  alkyl, 35 and  $\text{C}_1\text{-}\text{C}_3$  alkoxy;

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(iii) a group represented by the following graphic formula:

5



wherein A is methylene and D is oxygen; each R<sub>12</sub> is C<sub>1</sub>-C<sub>3</sub> alkyl, or C<sub>1</sub>-C<sub>3</sub> alkoxy; R<sub>13</sub> and R<sub>14</sub> are each hydrogen or C<sub>1</sub>-C<sub>3</sub> alkyl; and q is the integer 0, or 1; or

10 (d) B and B' taken together form fluoren-9-ylidene, adamantlylidene, bornylidene, norbornylidene, or bicyclo[3.3.1]nonan-9-ylidene.

15 4. A naphthopyran compound selected from:

- (a) 3,3,9-triphenyl-3H-9H-indeno[3',2':3,4]naphtho[1,2-b]pyran;
- (b) 3,3-di(4-methoxyphenyl)-9-phenyl-3H-9H-indeno[3',2':3,4]naphtho[1,2-b]pyran;
- 20 (c) 3-(4-methoxyphenyl)-3,9-diphenyl-3H-9H-indeno[3',2':3,4]naphtho[1,2-b]pyran;
- (d) 3-(4-morpholinophenyl)-3,9-diphenyl-3H-9H-indeno[3',2':3,4]naphtho[1,2-b]pyran;
- (e) 3,3-di(4-methoxyphenyl)-9-(3-methoxyphenyl)-
- 25 11-methoxy-3H-9H-indeno[3',2':3,4]naphtho[1,2-b]pyran;
- (f) 3-(4-methoxyphenyl)-3-phenyl-9-(3-methoxyphenyl)-11-methoxy-3H-9H-indeno[3',2':3,4]naphtho[1,2-b]pyran;
- (g) 3-(4-methoxyphenyl)-3-phenyl-9-methyl-11-
- 30 methoxy-9-(3-methoxyphenyl)-3H-9H-indeno[3',2':3,4]naphtho[1,2-b]pyran;
- (h) 3,3-di(4-methoxyphenyl)-9-methyl-11-methoxy-9-(3-methoxyphenyl)-3H-9H-indeno[3',2':3,4]naphtho[1,2-b]pyran;
- (i) 3,3-di(4-methoxyphenyl)-9-methyl-11-methoxy-
- 35 3H-9H-indeno[3',2':3,4]naphtho[1,2-b]pyran;

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- (j) 3,3-di(4-methoxyphenyl)-9,9-dimethyl-11-methoxy-3H-9H-indeno[3',2':3,4] naphtho[1,2-b]pyran;
- (k) 3-(4-methoxyphenyl)-3-phenyl-9,9-dimethyl-11-methoxy-3H-9H-indeno[3',2':3,4]naphtho[1,2-b]pyran;
- 5 (l) 3,3-di(4-methoxyphenyl)-9,9-dimethyl-7,11-dimethoxy-3H-9H-indeno[3',2':3,4]naphtho[1,2-b]pyran;
- (m) 3-(4-methoxyphenyl)-3-phenyl-9,9-dimethyl-7,11-dimethoxy-3H-9H-indeno[3',2':3,4]naphtho[1,2-b]pyran;
- 10 (n) 3-(4-morpholinophenyl)-3-phenyl-9,9-dimethyl-7,11-dimethoxy-3H-9H-indeno[3',2':3,4]naphtho[1,2-b]pyran;
- (o) 3,3-di(4-methoxyphenyl)-9-methyl-11,13-dimethoxy-3H-9H-indeno[3',2':3,4]naphtho[1,2-b]pyran;
- (p) 3-(4-methoxyphenyl)-3-phenyl-9-methyl-11,13-dimethoxy-3H-9H-indeno[3',2':3,4]naphtho[1,2-b]pyran;
- 15 (q) 3-(4-methoxyphenyl)-3-phenyl-9,9-dimethyl-3H-9H-benzo[4'',5'']indeno[3',2':3,4]naphtho[1,2-b]pyran; and
- (r) 3,3-di(4-methoxyphenyl)-9,9-dimethyl-11-fluoro-3H-9H-indeno[3',2':3,4]naphtho[1,2-b]pyran.

20 5. A photochromic article comprising a polymeric organic host material and a photochromic amount of the naphthopyran compound of claim 1.

6. The photochromic article of claim 5 wherein  
25 the polymeric organic host material is selected from the group consisting of poly(C<sub>1</sub>-C<sub>12</sub> alkyl methacrylates), poly(oxyalkylene dimethacrylates), poly(alkoxylated phenol methacrylates), cellulose acetate, cellulose triacetate, cellulose acetate propionate, cellulose acetate butyrate,  
30 poly(vinyl acetate), poly(vinyl alcohol), poly(vinyl chloride), poly(vinylidene chloride), thermoplastic polycarbonates, polyesters, polyurethanes, polythiourethanes, poly(ethylene terephthalate), polystyrene, poly(alpha methylstyrene), copoly(styrene-methylmethacrylate),  
35 copoly(styrene-acrylonitrile), polyvinylbutyral and polymers of members of the group consisting of bis(allyl carbonate)

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monomers, polyfunctional acrylate monomers, polyfunctional methacrylate monomers, diethylene glycol dimethacrylate monomers, diisopropenyl benzene monomers, ethoxylated bisphenol A dimethacrylate monomers, ethylene glycol  
5 bismethacrylate monomers, poly(ethylene glycol) bismethacrylate monomers, ethoxylated phenol bismethacrylate monomers, alkoxyLATED polyhydric alcohol acrylate monomers, styrene monomers, urethane acrylate monomers, glycidyl acrylate monomers, glycidyl methacrylate monomers and  
10 diallylidene pentaerythritol monomers.

7. The photochromic article of claim 6 wherein the polymeric organic host material is a solid transparent polymer selected from the group consisting of poly(methyl methacrylate), poly(ethylene glycol bismethacrylate),  
15 poly(ethoxylated bisphenol A dimethacrylate), thermoplastic polycarbonate, poly(vinyl acetate), polyvinylbutyral, polyurethane, polythiourethane and polymers of members of the group consisting of diethylene glycol bis(allyl carbonate)  
20 monomers, diethylene glycol dimethacrylate monomers, ethoxylated phenol bismethacrylate monomers, diisopropenyl benzene monomers and ethoxylated trimethylol propane triacrylate monomers.

25 8. The photochromic article of claim 7 wherein the photochromic compound is present in an amount of from 0.05 to 2.0 milligram per square centimeter of organic host material surface to which the photochromic substance(s) is incorporated or applied.

30

9. The photochromic article of claim 8 wherein said article is a lens.

35 10. A photochromic article comprising a polymeric organic host material selected from the group consisting of poly(methyl methacrylate), poly(ethylene glycol

bismethacrylate), poly(ethoxylated bisphenol A dimethacrylate), thermoplastic polycarbonate, poly(vinyl acetate), polyvinylbutyral, polyurethane, polythiourethane and polymers of members of the group consisting of diethylene 5 glycol bis(allyl carbonate) monomers, diethylene glycol dimethacrylate monomers, ethoxylated phenol bismethacrylate monomers, diisopropenyl benzene monomers and ethoxylated trimethylol propane triacrylate monomers, and a photochromic amount of the naphthopyran compound of claim 2.

10

11. A photochromic article comprising a polymeric organic host material selected from the group consisting of poly(methyl methacrylate), poly(ethylene glycol bismethacrylate), poly(ethoxylated bisphenol A dimethacrylate), thermoplastic polycarbonate, poly(vinyl acetate), polyvinylbutyral, polyurethane, polythiourethane and polymers of members of the group consisting of diethylene 15 glycol bis(allyl carbonate) monomers, diethylene glycol dimethacrylate monomers, ethoxylated phenol bismethacrylate monomers, diisopropenyl benzene monomers and ethoxylated trimethylol propane triacrylate monomers, and a photochromic 20 amount of the naphthopyran compound of claim 3.

12. A photochromic article comprising a 25 polymerizate of an optical organic resin monomer and a photochromic amount of the naphthopyran compound of claim 1.

13. The photochromic article of claim 12 wherein the refractive index of the polymerizate is from about 1.48 30 to about 1.75.

14. The photochromic article of claim 12 wherein the polymerizate is an optical element.

35 15. The photochromic article of claim 14 wherein said optical element is an ophthalmic lens or a contact lens.

16. A photochromic article comprising, in combination, a solid transparent polymeric organic host material, and a photochromic amount of each of (a) at least 5 one naphthopyran compound of claim 1, and (b) at least one other organic photochromic compound having at least one activated absorption maxima within the range of between about 400 and 700 nanometers.

10 17. The photochromic article of claim 16 wherein the polymeric organic host material is a solid transparent homopolymer or copolymer selected from the group consisting of poly(methyl methacrylate), poly(ethylene glycol bis-methacrylate), poly(ethoxylated bisphenol A dimethacrylate), 15 thermoplastic polycarbonate, poly(vinyl acetate), polyvinylbutyral, polyurethane, polythiourethane and polymers of members of the group consisting of diethylene glycol bis(allyl carbonate) monomers, diethylene glycol dimethacrylate monomers, ethoxylated phenol bismethacrylate 20 monomers, diisopropenyl benzene monomers and ethoxylated trimethylol propane triacrylate monomers.

18. The photochromic article of claim 16 wherein the organic photochromic compound (b) is selected from the 25 group consisting of naphthopyrans, benzopyrans, phenanthropyrans, indenonaphthopyrans, oxazines, organo-metal dithizonates, fulgides, fulgimides, spiro(indoline)pyrans and mixtures thereof.

30 19. The photochromic article of claim 18 wherein the total amount of photochromic compound present is from 0.05 to 1.0 milligram per square centimeter of organic host material surface to which the photochromic substance(s) is incorporated or applied.

20. The photochromic article of claim 19 wherein  
the article is an ophthalmic lens on a contact lens.

21. A photochromic article comprising, in  
5 combination, a polymeric organic host material selected from  
the group consisting of poly(methyl methacrylate),  
poly(ethylene glycol bismethacrylate), poly(ethoxylated  
bisphenol A dimethacrylate), thermoplastic polycarbonate,  
poly(vinyl acetate), polyvinylbutyral, polyurethane,  
10 polythiourethane and polymers of members of the group  
consisting of diethylene glycol bis(allyl carbonate) monomers,  
diethylene glycol dimethacrylate monomers, ethoxylated phenol  
bismethacrylate monomers, diisopropenyl benzene monomers and  
ethoxylated trimethylol propane triacrylate monomers, and a  
15 photochromic amount of each of (a) at least one naphthopyran  
compound of claim 3, and (b) at least one other organic  
photochromic compound having at least one activated absorption  
maxima within the range of between about 400 and 700  
nanometers.